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ABSTRACT

The relationship between fertility and the HIV/AIDS epidemic is not well understood. Although existing studies elsewhere generally point to the epidemic resulting in fertility reduction, earlier evidence from the *Kenya Demographic and Health Survey 2003* (Central Bureau of Statistics [CBS], Kenya Ministry of Health [MOH] & ORC Macro, 2004), hereafter referred to as KDHS, showed interesting patterns, with regions most adversely affected with the HIV/AIDS epidemic showing the clearest sign of a reversal trend in fertility decline. HIV/AIDS may influence fertility through one or more behavioral and/or biological proximate fertility determinants. In this study, we explore: (i) the regional variations in the link between HIV/AIDS and fertility; (ii) possible mechanisms through which HIV/AIDS may influence fertility; and (iii) the effect of individual and contextual community-level HIV/AIDS factors on fertility.

The study is based on secondary analysis of the 2003 KDHS data, which provides a unique opportunity to explore the impact of the HIV/AIDS epidemic on the affected populations, being the fourth survey in the international DHS program to include HIV testing, and the first to anonymously link the HIV results with key behavioral, social, and demographic factors at individual and household level. Multilevel models are used to examine the effect of individual and contextual community-level HIV/AIDS factors on fertility. The modeling is carried out in stages, starting with the key variables relating to HIV/AIDS, before introducing various proximate fertility determinants in successive stages, to explore possible mechanisms through which HIV/AIDS may influence fertility.

The study corroborates findings of earlier studies on the fertility inhibiting effect of HIV/AIDS among infected women. HIV/AIDS infected women have 40 percent lower odds of having had a recent birth than their uninfected counterparts of similar background characteristics and child mortality experience. After taking into account proximate determinants of fertility relating to sexual exposure, breastfeeding duration, and fetal loss, the odds for HIV/AIDS infected women are 33 percent lower, suggesting that the effect of HIV/AIDS on fertility is partly through these proximate determinants. However, there is no evidence of a significant association between community level HIV/AIDS prevalence and fertility when the background socio-cultural and demographic factors are controlled for.

The results suggest that although recent trends in sexual exposure factors (e.g. rising age at first sex and age at first marriage and a decline in the proportion of women in union) might be expected to sustain a declining trend in fertility, trends in some of the proximate determinants, including reduced duration of breastfeeding and increased child mortality coupled with reduced desire to stop childbearing may have contributed to the stalled fertility decline in Kenya. Whilst HIV/AIDS may have influenced the recent changes in sexual exposure factors, it is also likely that it has contributed to increasing infant and child mortality and reduced duration of breastfeeding, which are partly responsible for the stall in fertility decline.

The regional patterns show that the most notable increase in fertility and the greatest decline in contraceptive prevalence were observed in Nyanza province, the region with the highest HIV/AIDS prevalence. The regional patterns of the other proximate determinants with respect to sexual exposure factors, infant/child mortality and duration of breastfeeding all show unfavorable patterns for the region. For instance, Nyanza has consistently recorded the lowest age at first sex, the lowest age at first marriage, and the highest infant and child mortality in Kenya across years. The recent trends in Nyanza have not been encouraging either: it witnessed the least overall rise in age at first sex and first marriage during the 1993-2003 period; and recorded among the greatest declines in the duration of breastfeeding. These patterns are likely to have contributed to the observed reversal of fertility decline in the region.

1 INTRODUCTION

1.1 Study Rationale and Objectives

Kenya has experienced one of the most dramatic fertility declines in world history, and although the fertility had earlier been projected to continue declining to a total fertility rate (TFR) of 3.2 by 2015-2020 (CBS, 2002), the KDHS showed that the decline in fertility has stalled at a TFR of about five children per woman with evidence of an upsurge in specific sub-groups (CBS et al., 2004; Westoff & Cross, 2006). This stall has been attributed in part to lack of recent progress in socio-economic development (Bongaarts, 2005). The overall stagnation in fertility decline was one of the most surprising and worrisome findings from the 2003 KDHS (CBS et al., 2004) and adds to the list of existing demographic challenges in the country, including the recent upsurge in infant and child mortality which has been partly attributed to the HIV/AIDS epidemic.

Although the impact of HIV/AIDS on mortality and life expectancy in Kenya is reasonably well understood (MOH, 2005), the possible impact of HIV/AIDS on fertility remains unclear. Early evidence from the 2003 KDHS showed interesting patterns, with the regions worst affected by HIV/AIDS epidemic (e.g. Nyanza Province), showing the clearest sign of a reversal trend in fertility decline. This calls for further investigations to better understand the possible link between the HIV/AIDS epidemic and the observed recent fertility patterns in the country, with particular reference to the most adversely affected regions. Westoff and Cross (2006) noted that although it seemed reasonable that the increase in child mortality, partly due to AIDS, had played a role in changes in reproductive intentions, additional work was needed to better understand the connections between concern about HIV/AIDS and the stall or reversal in reproductive preferences in Kenya. The current study focuses on the link between HIV/AIDS factors and recent fertility patterns in Kenya, with particular reference to individual and contextual community HIV/AIDS factors and role of the proximate fertility determinants. The main objectives of this study are:

- to examine regional variations in the link between HIV/AIDS and fertility;
- to explore possible mechanisms through which HIV/AIDS influences fertility; and
- to examine the effect of individual and contextual community level HIV/AIDS factors on fertility.

1.2 Understanding the Relationship between HIV/AIDS and Fertility

The HIV/AIDS epidemic is believed to be partly responsible for the recent upsurge in mortality in a number of countries in sub-Saharan Africa, but the effect on fertility has remained unclear. As illustrated by a United Nations study (2002), the relationship between HIV/AIDS and fertility is a complex one. First, the causality can run in either direction. While HIV/AIDS can affect fertility desires and outcomes, it is also possible for fertility to affect the risk of HIV/AIDS and disease progression. Second, HIV/AIDS and fertility may share common causes that induce an association between the two. In this analysis, we focus primarily on the effect of HIV/AIDS on fertility, which is itself not a straightforward one since HIV/AIDS can have a positive or a negative effect on fertility. It is, therefore, important that we recognize the possible complex interrelationships while interpreting our findings.

The effect of HIV/AIDS on fertility may operate both at the individual level and at the aggregate level. This effect can differ not only in magnitude but also in direction (United Nations, 2002). At the individual level, there may be differential effects on fertility on infected and uninfected women. The

effect of HIV/AIDS on fertility of infected persons (which is mainly through biological and behavioral factors) is far better understood, and with more precision than the corresponding effect for uninfected persons, which operates mainly through behavioral mechanisms (United Nations, 2002). Existing studies from sub-Saharan Africa show that fertility of HIV-positive women is 25 percent to 40 percent lower than for uninfected women (Ryder et al., 1991; Allen et al., 1993; Zaba & Gregson, 1998).

A reasonable understanding of the impact of HIV/AIDS on fertility requires an examination of the impact both at the individual level as well as at the aggregate level. Unfortunately, few studies in sub-Saharan Africa have data linking the epidemic and fertility of populations. Existing studies across sub-Saharan Africa generally support the claim that fertility has been decreased by the HIV/AIDS epidemic (Ntozi, 2001). However, the patterns of fertility and HIV/AIDS recently observed in Kenya, where the region with highest HIV/AIDS prevalence also showed the greatest fertility upsurge (CBS et al., 2004) does not conform to the general patterns earlier observed in other countries in sub-Saharan Africa region.

In his review of the impact of HIV/AIDS on fertility in sub-Saharan Africa, Ntozi (2001) noted that the contribution of HIV/AIDS to current fertility transitions in sub-Saharan Africa is not evident for four reasons. Firstly, isolating the factor of HIV/AIDS from other factors of fertility is a complex process because it is not a proximate variable, but one of the contributors to several proximate determinants of fertility. Secondly, for the impact of the epidemic to be felt, the prevalence has to be high (in the region of 20 percent) and sustained for a long time of a decade or longer. Thirdly, behavior factors may reduce fertility of women with symptoms of AIDS, but not those asymptomatic, since many women in sub-Saharan Africa are not aware of their sero-status. Fourthly, as infant mortality increases, the need to replace dead children and reproduce more to ensure survival of some will challenge implementation of family planning programs. Furthermore, increasing HIV/AIDS prevalence in the region will mean that HIV/AIDS programs will compete for resources with family planning programs, which would weaken the latter. Ntozi (2001) concluded that although available studies point to the epidemic resulting in fertility reduction, what was lacking in understanding of the impact of the epidemic on fertility was data on population level to understand the relationship at macro level.

1.3 Conceptual Framework

HIV/AIDS is likely to influence fertility of individual women through a number of behavioral and biological factors; namely, marriage, contraception, breastfeeding, postpartum abstinence, fetal loss, pathological, and natural sterility. For example, fertility may decline in the era of AIDS because of: delayed onset of sexual relations and age at first union; reduced premarital sexual relations and remarriage, and increased marital resolution and spousal separation; increased condom use; increased duration of postpartum amenorrhea (PPA); reduced pregnancy rates and increased fetal loss; increased prevalence of sexually transmitted diseases (STDs)[1]; and reduced frequency of sexual intercourse and production of spermatozoa. On the other hand, HIV/AIDS may increase fertility through: reduced breastfeeding; reduced postpartum abstinence; and increased infant mortality.

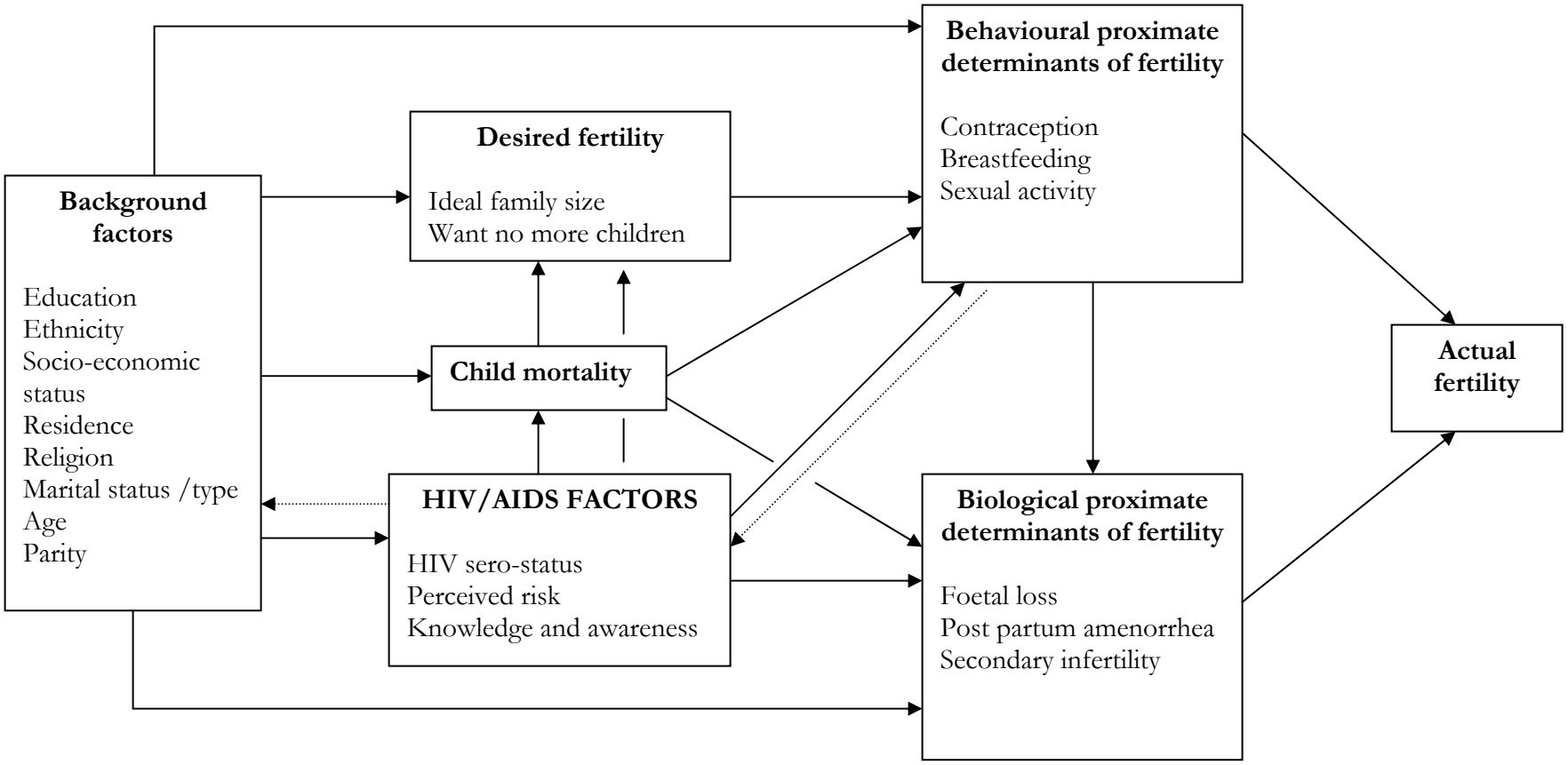
HIV/AIDS may influence fertility through one or more behavioral or biological proximate fertility determinants. A conceptual framework used for the analysis of the link between HIV/AIDS is given in

[1] Co-infection of HIV/AIDS with other STDs (gonorrhoea, syphilis, and chlamydia) is an important explanation for reduced fecundability. It has been reported that gonorrhoea and syphilis transmission rates double in presence of HIV, while even more dramatic is the effect of gonorrhoea and syphilis on HIV/AIDS transmission (Bracher & Santow, 2001, as cited in United Nations, 2002).

Figure 1.1. HIV/AIDS factors, including sero-status, perceived risk and knowledge may influence desired fertility either directly or through child mortality. Desired fertility in turn influences actual fertility through behavioral proximate determinants of fertility, mainly contraception. Alternatively, HIV/AIDS factors may directly influence the behavioral or biological proximate fertility determinants, which in turn influence actual fertility. A number of factors in the background may influence desired fertility or proximate fertility determinants either directly or through HIV/AIDS related factors.

In their analysis of factors associated with the stall in fertility decline in Kenya, Westoff and Cross (2006) noted that the stall in rise of contraceptive prevalence could be mainly due to a decline in the proportion of women who want no more children. They noted that, in general, the evidence about the connections of AIDS, child mortality, and reproductive intention in Kenya were consistent with the conclusions of earlier studies in Kenya and Tanzania that an increase in child mortality can be expected to increase fertility, while an increase in adult mortality or concerns about AIDS would reduce fertility (Ainsworth, Filmer & Semali, 1998; Gyimah & Rajulton, 2004).

Figure 1.1 Conceptual framework for analysis of the link between HIV/AIDS and fertility.



2 DATA AND METHODS

2.1 The Data

This study is based on secondary analysis of the 2003 KDHS data. The 2003 KDHS provides a unique opportunity to explore the impact of the HIV/AIDS epidemic on the affected populations, being the fourth survey in the international DHS program to include HIV testing, and the first to link the HIV results anonymously with key behavioral, social, and demographic factors (CBS et al., 2004). The 2003 KDHS data make it possible to link HIV/AIDS status of individual women with their behavioral and demographic characteristics, including fertility behavior.

The 2003 KDHS was a nationally representative sample survey of 8,195 women aged 15-49 and 3,578 men aged 15-54 selected from 400 sample points (clusters) throughout Kenya. This study used primarily the women sample, although some community level factors (e.g. proportion of men in the cluster who are circumcised, HIV prevalence) were derived from the male sample or a combination of the two samples. The survey used a two-stage sample and was designed to produce separate estimates of key indicators for each of the eight provinces in Kenya. The first stage involved selecting clusters from a national master sample frame, while the second stage involved a systematic sample of households within each cluster. All women aged 15-49 in sampled households were eligible for the interview. In every second household selected for the survey, all men aged 15-54 were eligible to be interviewed. One of the important features of the 2003 KDHS was HIV/AIDS testing of adults. All women and men living in households selected for the men's questionnaire were asked to give voluntary a few drops of blood for HIV testing.

Specific information of interest in this study relate to information on fertility, HIV/AIDS, and the proximate determinants of fertility. The fertility outcome variables (at individual level) include: actual fertility (recent fertility experience, within the last three years); and desired fertility (ideal family size; whether want no more children). The key HIV/AIDS variables include: HIV/AIDS sero-status; HIV/AIDS knowledge and perceived risk; and contextual community level HIV/AIDS factors, (including proportion of individuals who are HIV/AIDS sero-positive, proportion who perceive themselves to be at high risk of HIV/AIDS, and the proportion of men who are circumcised). The proximate determinants of fertility, through which HIV/AIDS may influence fertility included in the study were: sexual activity and marital resolution/dissolution; infant and child mortality experience; contraception; breastfeeding practices; postpartum amenorrhea; and fetal loss.

2.2 Analytical Framework

The analysis covers three broad areas: background trends and regional variations in fertility and the proximate determinants; factors associated with HIV/AIDS infection; and the association between HIV/AIDS and fertility.

Background regional trends in fertility and the proximate determinants

An examination of background levels and trends of fertility and the proximate determinants in Kenya based on 1993, 1998 and 2003 KDHS make particular reference to various proximate determinants through which HIV/AIDS may influence fertility. Changes in the key proximate determinants examined include marital resolution/dissolution, contraception, breastfeeding practices, and infant mortality. The analysis in this section is limited to descriptive analysis of trends and regional variations. Of particular interest are the links between HIV prevalence and changes in various fertility indicators across regions, including desired and recent fertility.

Factors associated with HIV/AIDS infection

The analysis of factors associated with HIV/AIDS first examined possible selectivity bias in HIV/AIDS testing to assess the quality of HIV/AIDS test data before focusing on the correlates and risk factors of HIV/AIDS infection. The assessment of possible selectivity bias was carried out by examining (i) whether select sub-groups of the population were more likely to refuse HIV testing; and (ii) what implications the patterns of refusal may have on observed correlates and risk factors of HIV sero-status.

The analysis of correlates and risk factors of HIV/AIDS infection was based on bivariate as well as multivariate analysis. The latter involved use of multilevel models to take into account possible clustering of HIV/AIDS infection at cluster level, and allowed inclusion of both individual level as well as cluster-level factors. The risk factors of particular interest relate to HIV/AIDS awareness and perceptions, and sexual behavior and union factors. The modeling was carried out in various steps where blocks of variables relating to HIV/AIDS awareness/perceptions and sexual behavior/union risk factors were introduced in successive steps to explore whether HIV/AIDS awareness and risk perceptions may influence risk of infection through modification of sexual/union risk factors.

Association between HIV/AIDS and fertility

The analysis examined both the individual and contextual community-level HIV/AIDS risk factors on desired and actual fertility of individual women. The analysis of recent fertility incorporated the proximate determinants of fertility to decipher the mechanisms through which HIV/AIDS factors influence fertility. The multivariate analysis involved multilevel modeling, taking into account individual level factors as well as contextual community level effects. The contextual community-level factors relate mainly to averages within clusters.

In addition to the HIV/AIDS factors and proximate determinants of fertility variables mentioned in Section 2.1, a number of background factors known to be associated with fertility, such as educational attainment, age, residence (urban/rural), etc. were taken into account in the multivariate models and included as controls. The modeling was carried out in stages, starting with the key variables relating to HIV/AIDS, before introducing the various proximate determinants in successive stages, to explore possible mechanisms through which HIV/AIDS influences fertility.

Preliminary analysis was undertaken to determine the appropriate number of levels for the multilevel analysis (i.e., women: households: clusters: districts), and whether the response variables should be modeled as linear or discrete outcomes. Results from the preliminary analysis showed that most of the households (75 percent) had only one woman respondent, and there was little evidence of clustering of outcome of interest at district level, suggesting that a two-level model (with individual women at level-1 and cluster at level-2) sufficed. The distribution of the outcome variables suggested that a logistic, rather than a linear model was more appropriate for the outcomes analyzed.

The multilevel models allowed for the effect of HIV/AIDS factors to vary randomly at community-level to establish if there was any differential effect of HIV/AIDS in low-fertility and high-fertility communities. The general form of the random-coefficients two-level logistic model used in the analysis may be expressed as:

$$Logit\ \pi_{ij} = X'_{ij}\beta + Y'_{ij}u_j$$

Where:

π_{ij} - is the probability of a given outcome for a particular woman, i, in community, j ;
X'_{ij} - is the vector of covariates which may be defined at woman, or community level;
β - is the associated vector of fixed parameters;
Y'_{ij} - is a vector of covariates (usually a subset of X'_{ij}) the effects of which vary randomly at community level; and
u_j - is the vector of community-level random effects.

The multilevel regression analyses were carried out using the *MLwiN* statistical package (Rasbash, Steele, Browne & Prosser, 2004), and estimation based on second order PQL procedure (Goldstein, 1995).

3 BACKGROUND TRENDS AND REGIONAL VARIATIONS IN FERTILITY AND THE PROXIMATE DETERMINANTS

An examination of the background trends and regional variations in fertility and the proximate determinants is useful in identifying appropriate program targets for specific regions. For example, it is important to establish whether there are notable unique features of recent fertility patterns in worst affected regions such as Nyanza province. This section starts by examining background national trends in fertility and proximate determinants (Table 3.1) before focusing on regional variations. All the analyses in this section exclude data from the northern part of Kenya, which had been excluded in 1993 and 1998 surveys but were included in the 2003 survey.

Table 3.1 Background levels and trends of fertility and the proximate determinants

Indicator	1993	1998	2003	Percent change	
				1993-98	1998-03
Fertility indicators					
Total fertility rate (TFR)	5.4	4.7	4.8	-13.0	2.1
Desired family size	3.7	3.8	3.7	2.7	-2.6
Percent who want no more children[Φ]	51.7	53.3	48.7	1.9	-7.0
Total wanted fertility rate	3.4	3.5	3.5	2.9	0.0
Median birth interval	30.1	32.9	32.6	9.3	-0.9
Proximate determinants of fertility					
Percent in union	60.8	61.5	59.9	1.2	-2.6
Median age at first union	18.8	19.2	19.8	2.1	3.1
Median age at first sex	16.8	16.7	17.8	-0.6	6.6
Contraceptive prevalence[§]	27.3	31.5	32.9	15.4	4.4
Median duration of breastfeeding	21.1	20.9	20.1	-0.9	-3.8
Median duration of PPA	10.8	8.9	9.0	-17.6	1.1
Under age five mortality rate	96	112	115	16.7	2.7
Infant mortality rate	62	74	77	19.4	4.1

Note: National trends exclude the northern part of Kenya, which had been excluded in 1993 and 1998 surveys but was included in the 2003 survey.

§ - Contraceptive prevalence computed for only currently married women for modern methods.

Φ - Computed among currently married women; those sterilized considered to want no more children.

Overall, the desired family size and total wanted fertility remained fairly constant between 1993 and 2003. Notable fertility features include a drop in the proportion of women who want no more children and the stall in fertility decline. These fertility patterns seem inconsistent with changes in the proximate determinants of fertility with respect to sexual activity and marital union. The recent rise in age at first sex and age at first marriage and the drop in the proportion of women in union might be expected to sustain a declining trend in fertility. However, patterns in some of the proximate determinants of fertility, such as shortening of breastfeeding duration and stalled increase in contraceptive use are consistent with the observed stall in fertility decline. It is possible that the HIV/AIDS epidemic may have contributed to the recent breastfeeding patterns or the drop in the proportion of women who want no more children, through its contribution to the recent upsurge in infant and child mortality.

3.1 Regional Trends in Indicators of Recent Fertility

An examination of the regional variations in background trends of indicators of recent fertility (Table 3.2) show notable regional variations with respect to TFRs. Fertility declined in all regions between 1993 and 1998, the most dramatic declines being in Nairobi and Eastern provinces. However, from 1998 to 2003, only Central and Coast provinces (i.e. the two regions with lowest declines from 1993 to 1998) continued with fertility declines. All the other regions witnessed some increase in fertility, the increase being particularly prominent in Nyanza province and to some extent Rift Valley province.

The regional trends of wanted fertility show mixed patterns. Both regions with notable declines in wanted fertility during the 1993-98 period witnessed a stall (Nairobi) or a slight upsurge (Nyanza) during the 1998-2003 period. In Western, an increase in wanted fertility between 1993 and 1998 was followed with a decline between 1998 and 2003. For both Rift Valley and Central provinces, wanted TFR was more or less constant during the 1993-1998 period, but rose notably in the more recent period.

The median birth interval increased across all regions between 1993 and1998 (although in varying magnitude), but declined slightly or stalled in all regions during the more recent period. The mean ideal family size has remained fairly stable across regions, but there was an indication of an increase in Nairobi, especially during the 1998-2003 period. The proportion of women who want no more children declined in almost all regions during the 1998-2003 period, most notably in Coast, Nairobi, Rift Valley, Nyanza and Eastern provinces, the same regions (except Eastern) with significant increases during the earlier period.

Table 3.2 Regional trends in indicators of recent fertility

	1993	1998	2003	Percent change 1993-98	Percent change 1998-03
Total fertility rate (TFR)					
Nairobi	3.4	2.6	2.7	-23.5	3.8
Central	3.9	3.7	3.4	-5.1	-8.1
Coast	5.3	5.1	4.9	-3.8	-3.9
Eastern	5.9	4.7	4.8	-20.3	2.1
Nyanza	5.8	5.0	5.6	-13.8	12.0
Rift Valley	5.7	5.3	5.8	-7.0	9.4
Western	6.4	5.6	5.8	-12.5	3.6
Wanted TFR					
Nairobi	2.5	2.3	2.3	-8.0	0.0
Central	2.6	2.6	2.8	0.0	7.7
Coast	4.3	4.4	4.3	2.3	-2.3
Eastern	3.3	3.2	3.3	-3.0	3.1
Nyanza	4.1	3.7	3.8	-9.8	2.7
Rift Valley	3.6	3.7	4.1	2.8	10.8
Western	3.6	4.3	4.0	19.4	-7.0
Median birth intervals (five years prior to survey) in months					
Nairobi	32.0	35.9	34.9	12.2	-2.8
Central	30.0	38.8	36.6	29.3	-5.7
Coast	33.1	35.8	34.0	8.2	-5.0
Eastern	30.6	34.2	33.7	11.8	-1.5
Nyanza	29.4	32.0	31.6	8.8	-1.3
Rift Valley	30.2	31.7	31.9	5.0	0.6
Western	28.7	30.4	30.3	5.9	-0.3
Mean ideal family size					
Nairobi	2.7	2.9	3.2	7.4	10.3
Central	3.1	3.1	3.1	0.0	0.0
Coast	4.5	4.4	4.5	-2.2	2.3
Eastern	3.5	3.5	3.5	0.0	0.0
Nyanza	3.8	4.1	4.1	7.9	0.0
Rift Valley	4.1	4.2	4.1	2.4	-2.4
Western	3.8	4.1	4.0	7.9	-2.4
Percent who want no more children					
Nairobi	45.4	49.7	41.7	9.5	-16.1
Central	64.3	63.0	61.0	2.1	-3.2
Coast	30.4	42.0	33.2	38.2	-21.0
Eastern	62.1	62.6	57.6	0.8	-8.0
Nyanza	47.2	51.2	47.0	8.5	-8.2
Rift Valley	48.5	53.8	48.1	10.9	-10.6
Western	53.7	51.7	52.0	-3.7	0.6

3.2 Regional Trends in Proximate Determinants of Fertility

The regional trends in proximate determinants of fertility show that contraceptive prevalence increases in all regions except Western province, during 1993-98 (Table 3.3). However, it was only in Western province where a notable increase in contraceptive prevalence was observed during 1998-2003. Whilst changes in contraceptive prevalence were minimal in the other regions during the later period, a notable decline was observed in Nyanza province.

Table 3.3 Regional trends in proximate determinants of fertility and under-five mortality

	1993	1998	2003	Percent change 1993-98	Percent change 1998-2003
Current contraceptive use					
Nairobi	37.8	46.8	44.3	23.8	-5.3
Central	49.7	54.8	57.9	10.3	5.7
Coast	16.6	20.0	19.1	20.5	-4.5
Eastern	30.5	36.0	38.4	18.0	6.7
Nyanza	21.5	25.0	21.0	16.3	-16.0
Rift Valley	21.0	26.4	24.5	25.7	-7.2
Western	21.7	21.9	27.3	0.9	24.7
Median duration of breastfeeding					
Nairobi	19.5	19.8	16.7	1.5	-15.7
Central	20.3	19.7	19.0	-3.0	-3.6
Coast	21.1	20.5	21.5	-2.8	4.9
Eastern	24.8	23.0	24.7	-7.3	7.4
Nyanza	21.2	20.3	18.2	-4.2	-10.3
Rift Valley	19.5	20.8	19.4	6.7	-6.7
Western	23.0	22.0	18.9	-4.3	-14.1
Median duration of postpartum amenorrhea					
Nairobi	4.5	4.7	6.8	4.4	44.7
Central	6.3	7.1	5.9	12.7	-16.9
Coast	13.0	7.6	9.6	-41.5	26.3
Eastern	12.6	7.9	10.2	-37.3	29.1
Nyanza	10.4	11.3	11.7	8.7	3.5
Rift Valley	10.7	9.7	11.1	-9.3	14.4
Western	12.4	8.8	9.5	-29.0	8.0
Under five mortality					
Nairobi	82	66	95	-20	44
Central	41	34	54	-17	59
Coast	109	96	116	-12	21
Eastern	66	78	84	18	8
Nyanza	187	199	206	6	4
Rift Valley	61	68	77	11	13
Western	110	123	144	12	17

The average duration of breastfeeding did not change much in all regions during 1993-98, but some decline were observed in Nairobi, Western, and Nyanza in the more recent period. The trends in duration of postpartum amenorrhea show rather erratic patterns across regions, with significant declines in Coast, Eastern, and Western provinces during the 1993-98 period, and notable increases in Nairobi, Eastern, and Coast provinces during the more recent period. Nyanza consistently recorded the highest under-five mortality levels over the years. There was an upsurge in under-five mortality in all regions during the 1998-2003 period, particularly so in Nairobi, Central, and Coast provinces, the regions where declines were observed in the earlier period.

The regional patterns in sexual exposure (Table 3.4) show some increase in the proportion of women of reproductive age in union in Central and some decline in Eastern during the 1993-98 period. Notable declines were observed in Central, Nairobi, and Western during the more recent period.

Table 3.4 Regional trends in sexual exposure factors

	1993	1998	2003	Percent change	
				1993-98	1998-03
Percent in union					
Nairobi	53.4	53.0	48.5	-0.7	-8.5
Central	55.8	61.1	54.8	9.5	-10.3
Coast	59.7	61.4	61.3	2.8	-0.2
Eastern	62.2	56.2	58.5	-9.6	4.1
Nyanza	63.4	62.9	63.4	-0.8	0.8
Rift Valley	61.2	62.4	65.4	2.0	4.8
Western	64.7	64.7	59.9	0.0	-7.4
Median age at first marriage					
Nairobi	21.0	21.9	22.1	4.3	0.9
Central	20.1	20.7	21.1	3.0	1.9
Coast	17.4	18.3	18.6	5.2	1.6
Eastern	19.3	19.8	20.1	2.6	1.5
Nyanza	17.4	17.5	17.8	0.6	1.7
Rift Valley	18.6	18.7	19.4	0.5	3.7
Western	18.4	18.9	19.2	2.7	1.6
Median age at first sex					
Nairobi	17.9	17.3	19.2	-3.4	11.0
Central	17.8	16.8	18.4	-5.6	9.5
Coast	17.3	17.8	18.0	2.9	1.1
Eastern	16.7	16.7	17.6	0.0	5.4
Nyanza	15.5	15.6	15.9	0.6	1.9
Rift Valley	17.0	17.0	18.0	0.0	5.9
Western	16.6	17.5	17.2	5.4	-1.7

The median age at first marriage has continued to rise across regions during the two periods, albeit more notable in some regions than others. Across years, Nyanza province recorded the lowest age at first marriage. This was the only region where the median age at first marriage remained below 18 years. The most notable rise in age at first sex was observed in Nairobi and Central provinces during the 1998-2003 period. These two regions did show some decline in age at first sex during the earlier period. Like age at first marriage, age at first sex was lowest in Nyanza province, the only region where the median age at first sex has remained below 16 years.

3.3 HIV/AIDS Prevalence and Recent Trends in Fertility and Proximate Determinants by Region

The changes in fertility indicators during the 1993-2003 period show mixed patterns by HIV/AIDS prevalence (Table 3.5). Fertility declined most notably in Nairobi and Eastern province.

Table 3.5 HIV/AIDS prevalence and percent change (1993-2003) in fertility and proximate fertility determinants by region

Indicator	Nairobi	Central	Coast	Eastern	Nyanza	Rift Valley	Western
HIV/AIDS prevalence among women Φ	11.9	7.6	6.6	6.1	18.3	6.9	5.8
Percent change in fertility indicators							
Total fertility rate (TFR)	-19.7	-13.2	-7.7	-18.2	-1.8	2.4	-8.9
Total wanted fertility rate	-8.0	7.2	0.0	0.1	-7.1	13.6	12.4
Mean birth interval	9.4	23.6	3.2	10.3	7.5	5.6	5.6
Desired family size	17.7	0.0	0.1	0.0	7.9	0.0	5.0
Want no more children	-8.1	-5.1	9.2	-7.2	-0.4	0.8	-3.2
Percent change in proximate determinants of fertility							
Percent in union	-9.2	-0.8	2.6	-5.5	0.0	6.8	-7.4
Median age at first union	5.2	4.9	6.8	4.1	2.3	4.2	4.3
Median age at first sex	7.6	3.9	4.0	5.4	2.5	5.9	3.7
Contraceptive prevalence	18.5	16.0	16.0	24.7	0.3	18.5	25.6
Mean breastfeeding duration	-14.2	-6.6	2.1	0.1	-14.5	0.0	-18.4
Mean duration of PPA	49.1	-4.2	-15.2	-8.2	12.2	5.1	-21.0
Under five mortality	15.8	31.7	6.4	27.3	10.2	26.2	30.9

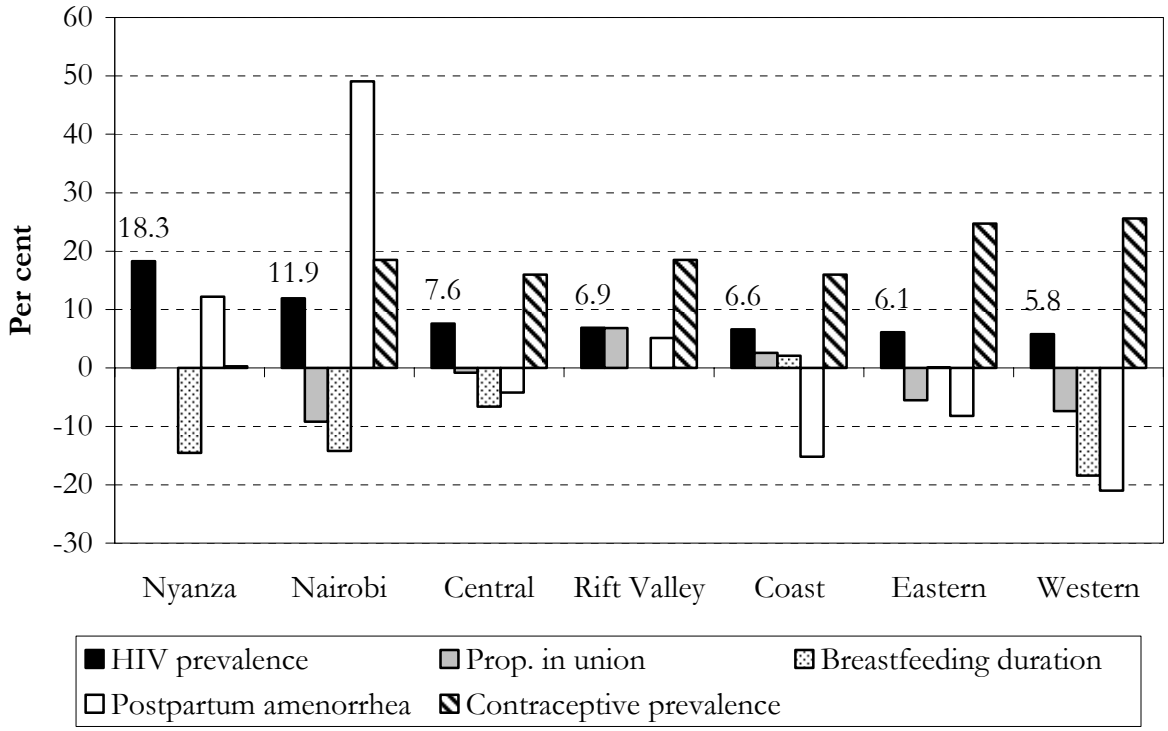
Φ - CBS et al., 2004:223.

The greatest decline in the proportion of women in union, the largest rise in the median age at first sex, and the largest rise in the mean duration of postpartum amenorrhea were all observed in Nairobi, the region with the second highest prevalence of HIV/AIDS. On the other hand, Nyanza province, the region with the highest HIV/AIDS prevalence, had the lowest overall rise in age at first sex and age at first marriage. Unlike all the other regions, Nyanza hardly witnessed any overall increase in contraceptive prevalence during the 1993-2003 period. Nairobi and Nyanza also had among the greatest declines in mean duration of breastfeeding and, at the same time, the most increase in mean duration of PPA. While the decline in mean duration of breastfeeding would be expected to result in a decline in the duration of PPA due to lactational amenorrhea, HIV infection may at the same time lead to increased menstrual disorders (Noel-Miller, 2003), resulting in increased duration of PPA. In Western province (i.e. the region

with the lowest HIV/AIDS prevalence), the notable decline in both the duration of breastfeeding and PPA does not support the HIV/AIDS explanation since this region has the lowest HIV/AIDS prevalence. It is interesting to note that the biggest increases in infant and child mortality are not in regions with the highest HIV/AIDS prevalence. In particular, Western province had among the biggest increases in infant/child mortality, yet it had the lowest HIV/AIDS prevalence. It is important to note that the unexpected patterns observed for Western province may have been due to recent declines in HIV/AIDS prevalence in the region (the province boarders Uganda, where dramatic declines in HIV/AIDS have been observed in recent years). Available district-level data on HIV/AIDS trends from sentinel surveillance suggest that in the late 1990s, Busia (urban) in Western province had the highest HIV/AIDS prevalence in the country (e.g. 32 percent in 1999, compared to 25 percent in Kisumu [urban], Nyanza provincial headquarters). By 2003, the prevalence in Busia had declined to 16 percent, while in Kisumu the prevalence was still high at 26 percent (National AIDS Control Council, 2005).

Overall, the regional variations in changes of some fertility indicators between 1993 and 2003 by HIV/AIDS prevalence show systematic patterns (Figure 3.1). There is a general tendency for: increases in contraceptive prevalence to be lower; increases in duration of postpartum amenorrhea to be higher; and declines in duration of breastfeeding to be greater (except for Western province) in regions of higher HIV/AIDS prevalence. For instance, the greatest increase in contraceptive prevalence was in regions with the lowest HIV/AIDS prevalence (i.e. Western and Eastern provinces) while hardly any increase was observed in the region with the highest HIV/AIDS prevalence (i.e. Nyanza). Also, the mean duration of PPA increased significantly in regions with the highest HIV/AIDS prevalence (i.e. Nyanza and Nairobi), but decline most noticeably in regions with the lowest HIV/AIDS prevalence (i.e. Western, Eastern, and Coast provinces). However, the regional patterns in changes in the proportion of women in union by HIV/AIDS prevalence do not show a clear pattern.

Figure 3.1 Percent change in selected fertility indicators (1993-2003) by region, ranked according to 2003 HIV/AIDS prevalence.



4 FACTORS ASSOCIATED WITH HIV/AIDS INFECTION

An examination of factors associated with HIV/AIDS is important in facilitating understanding of the link between HIV/AIDS and fertility. A number of background socio-economic and behavioral factors will possibly influence both HIV/AIDS and fertility independently, while others may influence fertility through HIV/AIDS-related factors. For instance, sexual behavior and condom use are likely to have direct effects on both HIV/AIDS and fertility. On the other hand, an individual's socio-economic status may influence vulnerability to HIV/AIDS infection, which in turn may influence fertility either through the biological proximate fertility determinants or through child mortality effect on fertility desires. The analysis of factors associated with HIV/AIDS infection is important in the interpretation of the HIV/AIDS and fertility link. This section begins with an assessment of possible selectivity bias in HIV/AIDS testing before examining correlates and risk factors of HIV/AIDS infection.

4.1 Possible Selectivity Bias in HIV/AIDS Testing

One of the data quality concerns relate to possible selectivity bias in HIV/AIDS testing. Of the 8,195 women interviewed in the 2003 KDHS, a random sample of about half (4,303) were targeted for HIV/AIDS testing, of whom 76 percent were actually tested. Reasons for not being tested included refusal (14 percent), absence (6 percent), and such other reasons as incapable of giving consent for testing, mismatch between questionnaire and blood sample, and other technical problems in taking blood (3 percent) (CBS et al., 2004). Coverage of HIV/AIDS testing varied significantly by region, ranging from a low of 55 percent in Nairobi to a high of 91 percent in Nyanza province. It is important to examine possible selectivity in HIV/AIDS testing by various factors related to HIV/AIDS and fertility, since this is likely to have implications on the observed relationships between HIV/AIDS and fertility. If observations were missing at random, then it is unlikely that the patterns of associations would be distorted. However, of particular concern are those who refused HIV/AIDS testing. This group may represent a select sub-group with respect to key characteristics associated with HIV/AIDS sero-status or fertility.

4.1.1 Refusal of HIV/AIDS testing by background characteristics

Bivariate analysis (Table 4.1) shows some indication of possible association between refusal and some key background characteristics that are also associated with HIV sero-status and fertility. There were strong regional differences, but it was interesting to note that refusal rates were lowest in Nyanza (4 percent) and highest in Nairobi (23 percent), the two regions with the highest HIV/AIDS prevalence rates.

The patterns of refusal by socio-economic and cultural factors show mixed patterns, with refusal rate being relatively high among the most affluent, and at the same time the more traditional and least affluent sub-groups. Refusal rates increased consistently with wealth index and were highest for women with higher education or no formal education. Among the socio-cultural attributes, there were strong associations with ethnicity and religion. Refusal rates were highest among the Kikuyu, Somali, and MijiKenda but lowest among the Kalenjin, Luhya, Luo, Kisii/Kuria. While the higher refusal rates among the Somali and the Mijikenda (who are predominantly Muslim) conform to higher refusal among Muslims, the higher refusal rate among the Kikuyu may be partly attributable to higher refusal among the more affluent sub-groups with respect to wealth and educational attainment.

There was no evidence of significant associations between refusal for HIV/AIDS test and demographic or sexual behavior factors, including age, marital status, sexual activity, and risky sexual behavior. Furthermore, the results with respect to HIV/AIDS perceptions and awareness were mixed. Perceived risk of HIV/AIDS was not significantly associated with refusal, while those who had not previously been

tested were more likely to refuse, as were those who had poor HIV/AIDS awareness or did not known anyone who was ill or had died of AIDS.

Table 4.1 Percent of respondents who refused HIV test by background characteristics

Characteristic	Categories	Percent who refused test	Number
Region of residence***	Nairobi	23.1	577
	Central	17.9	677
	Coast	11.9	444
	Eastern	15.6	482
	Nyanza	4.2	496
	Rift Valley	11.6	665
	Western	7.8	489
	North Eastern	20.4	191
Ethnic group***	Kikuyu	18.8	1017
	Luhya	8.8	603
	Luo	7.5	402
	Kamba	14.9	395
	Kalenjin	5.6	320
	Somali	25.7	276
	Mijikenda/Swahili	15.7	267
	Kisii	4.5	221
	Meru/Embu	18.6	231
	Other	13.8	289
Religion***	Catholic	12.6	945
	Protestant/other Christian	12.7	2526
	Muslim/other	21.2	532
Education*	None	16.5	632
	Primary	12.7	2150
	Secondary	13.8	958
	Higher	17.4	281
Wealth Index***	1st quartile (poorest)	9.7	966
	2nd quartile	10.4	1029
	3rd quartile	14.5	1020
	4th quartile (richest)	20.7	1006
Place of residence***	Urban	18.3	1339
	Rural	11.6	2682
Age group	15-19	14.3	914
	20-24	12.6	823
	25-29	12.2	649
	30-34	14.0	585
	35+	15.3	1050

Table 4.1 (continued)

Marital status	Never married	13.8	1192
	Currently married	13.8	2410
	Formerly married	14.3	419
Ever had sex	No	15.1	690
	Yes	13.6	3331
Multiple sex partners in last 12 months	No	13.8	3945
	Yes	17.1	76
Risky sexual behaviour[1]	No	14.0	3681
	Yes	11.8	340
HIV/AIDS awareness index***	1st quartile (poorest)	17.2	1000
	2nd quartile	13.4	1025
	3rd quartile	13.8	1002
	4th quartile (richest)	11.1	994
Knows someone	No	16.5	1015
who has died of AIDS**	Yes	12.9	2925
Ever been tested for AIDS*	No	14.4	3373
	Yes	11.3	576
HIV/AIDS risk perception	None	14.6	1441
	Small	13.4	1548
	Moderate/great	13.1	954
All		13.9	4021

Base population: women sampled for HIV/AIDS testing
1- Did not use condom at last sex with non-spousal partner.
*** - $p<0.001$, ** - $p<0.01$, * - $p<0.05$.

4.1.2 Risk factors in refusal of HIV/AIDS testing

Table 4.2 examines risk factors of refusal for HIV test to determine whether the above patterns observed in bivariate analysis would still hold when the effect of other significant factors are controlled for. Only region of residence, ethnic group, wealth status, and HIV/AIDS awareness remained significantly associated with refusal. Higher wealth index was an important factor in refusal. Also, the effect of ethnicity remained strong, with the Somali and Mijikenda being more likely to refuse, while the Kalenjin, Luo, Luhya and Kisii were less likely to refuse testing than the Kikuyu. It is clear that some of the observed patterns in the bivariate analysis were due to the effect of confounding factors. For instance, the relatively high refusal rates in North Eastern province observed in the bivariate analysis was most likely attributable to the high risk of refusal among the Somali, the predominant ethnic group in North Eastern province.

Table 4.2 Socio-economic and demographic risk factors of refusal for HIV/AIDS test

Parameter	Estimate (B)	S.E.	Sig.	Exp(B)
Wealth index				
1st quartile (poorest) [ref.]				
2nd quartile	0.26	0.167	0.116	1.30
3rd quartile	0.60	0.166	0.000	1.82
4th quartile (richest)	1.02	0.187	0.000	2.76
Region				
Nairobi [ref.]				
Central	-0.03	0.190	0.876	0.97
Coast	-1.32	0.316	0.000	0.27
Eastern	-0.02	0.249	0.944	0.98
Nyanza	-0.89	0.319	0.005	0.41
Rift Valley	-0.07	0.209	0.740	0.93
Western	-0.31	0.278	0.259	0.73
North Eastern	-0.97	0.345	0.005	0.38
Ethnic group				
Kikuyu [ref.]				
Luhya	-0.53	0.234	0.024	0.59
Luo	-0.61	0.265	0.022	0.55
Kamba	-0.14	0.220	0.539	0.87
Kalenjin	-1.05	0.293	0.000	0.35
Somali	1.06	0.283	0.000	2.90
Mijikenda /Swahili	1.13	0.363	0.002	3.11
Kisii	-0.79	0.393	0.046	0.46
Meru /Embu	-0.02	0.266	0.955	0.99
Other	0.08	0.232	0.746	1.08
HIV/AIDS awareness index				
1st quartile (poorest) [ref.]				
2nd quartile	-0.39	0.140	0.005	0.68
3rd quartile	-0.42	0.142	0.003	0.66
4th quartile (best)	-0.78	0.153	0.000	0.46

Overall, there is little evidence of systematic selectivity by key factors associated with HIV sero-status or fertility. The apparent lack of evidence of significant associations between refusal of HIV/AIDS testing and demographic factors such as age, marital status and sexual activity is somewhat re-assuring given the expected strong association between these factors and HIV sero-status. Although refusal is associated with some key factors such as region and ethnicity, the extent to which this may affect the analysis of factors associated with HIV/AIDS or the link between HIV/AIDS and fertility is difficult to disentangle as the patterns do not seem to point towards any specific direction. It is important that subsequent analysis control for the effects of these factors to minimize possible effects of selectivity in HIV/AIDS testing.

4.2 Bivariate Correlates of HIV/AIDS Infection

The results of the bivariate analysis of HIV/AIDS infection and background factors (Table 4.3a) showed a significant association between HIV/AIDS infection and educational attainment, but the relationship was not monotonic. Prevalence was highest among women with primary education and lowest among those with no formal education. Urban residence and greater wealth were both associated with higher HIV/AIDS prevalence. The prevalence was particularly high among Luo women for whom about one-quarter of those tested were sero-positive. On the other hand, prevalence was lowest among the Mijikenda/Swahili and other ethnic minorities. Women in the 25-34 age group or of parity 1-3 had the highest prevalence.

With respect to HIV/AIDS knowledge and perceptions (Table 4.3b), prevalence was higher among women with better HIV/AIDS knowledge, or who perceived their risk of infection as moderate or high. However, it is interesting to note that there was no significant association between personal acquaintance with HIV/AIDS victims and sero-status.

Table 4.3a Percent of women who tested HIV/AIDS sero-positive by background characteristics

Characteristic	Percent	No. of cases
Educational attainment **		
None	4.6	468
Primary incomplete	9.3	1009
Primary complete	10.6	753
Secondary +	8.1	965
Residence***		
Urban	12.1	960
Rural	7.8	2235
Wealth index ***		
Poorest quartile	6.4	813
2nd quartile	7.4	885
3rd quartile	9.7	814
Richest quartile	12.8	683
Ethnicity ***		
Kikuyu	6.5	746
Luhya	7.5	520
Luo	25.7	352
Kamba	7.3	309
Kalenjin	5.0	276
Mijikenda/Swahili	3.9	218
Kisii	7.4	207
Meru/Embu	5.7	170
Other	4.6	397
Religion*		
Catholic	8.9	748
Protestant	9.1	2046
Muslim/other	4.5	401
Region***		
Nairobi	11.9	349
Central	7.2	518
Coast	6.4	378
Eastern	5.4	377
Nyanza	18.2	463
Rift Valley	7.3	529
Western	5.7	437
North Eastern	0.0	144
Age ***		
15-19 years	2.9	714
20-24	9.7	665
25-29	13.1	523
30-34	10.9	460
35 +	9.2	833
Parity ***		
0	3.6	882
1	13.3	479
2-3	12.3	772
4-5	9.5	521
6 +	7.3	541
All	8.7	3195

*** - $p<0.001$, ** - $p<0.01$, * - $p<0.05$.

Table 4.3b Percent of women who tested HIV/AIDS sero-positive by HIV/AIDS knowledge and perceptions

Characteristic	Percent	Cases
Index of HIV/AIDS awareness **		
1st quartile (poorest)	5.6	727
2nd quartile	8.9	831
3rd quartile	9.7	811
4th quartile (best)	10.1	826
HIV/AIDS risk perception ***		
No risk	5.3	1153
Low risk	9.8	1255
Moderate/high risk	11.6	787
Personally knows someone with or died of HIV/AIDS		
No	7.5	793
Yes	9.1	2402
All	8.7	3195

*** - $p<0.001$, ** - $p<0.01$, * - $p<0.05$.

Sexual or union characteristics showed strong associations with HIV/AIDS sero-status (Table 4.3c). Younger age at first sex, having multiple sex partners, premarital sex and other high risk sexual behavior (i.e. non-use of condom at last sex with partner other than spouse) were all associated with higher HIV/AIDS prevalence. Prevalence was particularly high among the widowed, for whom three in every 10 were HIV/AIDS positive.

Table 4.3c Percent of women who tested HIV/AIDS sero-positive by sexual/union behavior

Characteristic	Percent	Cases
Age at first sex[Ψ, ***]		
15 or younger	12.5	929
16-17	9.5	660
18-19	9.7	593
20 +	6.1	491
Never had sex	1.5	522
Premarital sex***		
No	6.8	1042
Yes	11.9	1631
Never had sex	1.5	522
Multiple sex partners***		
No	9.8	2618
Yes	20.6	55
Never had sex	1.5	522
Risky sexual behavior[1, ***]		
No	9.1	2391
Yes	18.2	282
Never had sex	1.5	522
Age at first marriage***		
15 or younger	9.6	397
16-17	9.3	494
18-19	10.5	547
20 +	11.2	837
Never married	4.7	920
Current marital/union status ***		
Never married	4.7	920
Married (monogamous)	7.1	1564
Married (polygamous)	11.8	374
Widowed	31.4	130
Divorced/separated	18.8	207
All	8.7	3195

Base population: women sample tested for HIV/AIDS (n=3195)
Ψ – Some cases missing due to inconsistencies in reported data.
1 - Did not use condom during last sex with partner other than spouse
*** - $p<0.001$, ** - $p<0.01$, * - $p<0.05$

The bivariate associations between various factors and HIV/AIDS infection presented in this section may be confounded by the effect of other related factors. For instance, the association between HIV/AIDS

sero-status and educational attainment may be influenced by HIV/AIDS knowledge since education and awareness levels are related. Multivariate analysis in the next sub-section aims at identifying independent risk factors associated with HIV/AIDS infection.

4.3 Risk Factors of HIV/AIDS Infection

The multivariate analysis started by examining the background socio-economic and demographic factors independently associated with HIV/AIDS infection, taking into account the effect of other significant background factors (Model 1). This was followed with an examination of the relationship between HIV/AIDS awareness/perceptions and HIV/AIDS infection, controlling for the effect of significant background factors (Model 2). The final model included sexual behavior factors to explore whether the background factors and HIV/AIDS awareness and perceptions were associated with the risk of HIV/AIDS infection through sexual behavior. The explanatory factors incorporated in the model included individual and contextual community-level factors that may be associated with the risk of HIV/AIDS infection, including prevalence of male circumcision in the community. The key questions that the analysis sought to address were: what individual and community level factors were associated with the risk of HIV/AIDS infection; whether HIV/AIDS knowledge and risk perception influenced the risk of infection through reduced risky sexual behavior; and, how the relationship between HIV/AIDS knowledge, risk perception, and risk of infection varied between high-prevalence and low-prevalence communities.

The results of the multivariate analysis largely confirmed the associations observed in the bivariate analysis with respect to background socio-economic and demographic factors (Table 4.4). However, some of the apparent associations between HIV/AIDS infection and background factors (e.g. educational attainment, age) observed in the bivariate analysis or in Model 1 or Model 2 were partly attributable to sexual behavior or union characteristics. Although primary level education is associated with the highest risk of HIV/AIDS infection, the difference between primary and secondary level education were not significant when sexual behavior was controlled for.

It is interesting to note that the associations between HIV/AIDS awareness/perceptions and sero-status were not significant when the effect of background factors were controlled for. It is possible that the apparent association observed between HIV/AIDS sero-status and awareness or risk perception in the bivariate analysis were due to the effect of other background factors such as education or age, which are themselves associated with HIV/AIDS awareness and risk perception. The only HIV/AIDS awareness or risk perception factor associated with the risk of infection is community level acquaintance with HIV/AIDS victims. As might be expected, women in communities where a relatively high proportion reported knowing someone ill or dead from AIDS were more likely to be infected. It is interesting to note that this factor only became significant when sexual/union risk factors were controlled for, suggesting that communities in which a higher proportion of people know someone with AIDS are also more likely to have protective sexual behavior. Further analysis (not shown) suggests that the proportion of males in the community who are circumcised and, to a less extent, marital/union status and the proportion of males in the community who reported extramarital sex all contributed to the increase in significance of the proportion in the community who knew someone with HIV/AIDS.

Table 4.4 Parameter estimates of individual and community-level factors associated with HIV/AIDS infection (standard errors are given in brackets)

Parameter	Model 1	Model 2	Model 3
Intercept	-3.41(0.400)	-4.62(0.799)	-5.29(0.946)
Background control factors			
Educational attainment (secondary +)[1]			
None	0.17(0.318)	0.21(0.326)	-0.20(0.350)
Primary incomplete	0.63(0.197)*	0.66(0.204)*	0.41(0.215)
Primary complete	0.51(0.188)*	0.52(0.191)*	0.36(0.198)
Rural residence (urban)[1]	-0.37(0.208)	-0.41(0.210)*	-0.38(0.219)
Wealth index (poorest quartile)[1]			
2nd quartile	0.33(0.221)	0.33(0.222)	0.36(0.233)
3rd quartile	0.50(0.232)*	0.48(0.234)*	0.49(0.245)*
Richest quartile	0.36(0.299)	0.34(0.306)	0.47(0.321)
Ethnicity (Kikuyu)[1]			
Luhya	0.35(0.234)	0.32(0.222)	0.18(0.250)
Luo	1.93(0.209)*	1.98(0.227)*	1.48(0.287)*
Kamba	0.32(0.262)	0.44(0.303)	0.46(0.312)
Kalenjin	0.03(0.332)	0.11(0.340)	0.02(0.360)
Mijikenda /Swahili	-0.34(0.388)	-0.25(0.415)	-0.31(0.438)
Kisii	0.31(0.325)	0.33(0.330)	0.39(0.339)
Meru/Embu	-0.25(0.380)	-0.23(0.384)	-0.07(0.389)
Other	0.14(0.323)	0.22(0.341)	0.12(0.366)
Age (35+)[1]			
15-19 years	1.67(0.350)*	-1.66(0.354)*	-1.22(0.387)*
20-24	0.80(0.251)*	-0.81(0.253)*	-0.43(0.277)
25-29	-0.20(0.225)	-0.23(0.227)	0.12(0.245)
30-34	-0.10(0.215)	-0.11(0.216)	0.18(0.231)
Parity (6 +)[1]			
0	0.34(0.362)	0.40(0.363)	0.71(0.417)
1	1.28(0.307)*	1.30(0.308)*	1.26(0.335)*
2-3	0.95(0.256)*	0.95(0.256)*	0.91(0.274)*
4-5	0.21(0.256)	0.22(0.257)	0.12(0.271)
HIV/AIDS awareness/perceptions			
Index of awareness (lowest quartile)[1]			
2nd quartile		0.25(0.233)	0.17(0.242)
3rd quartile		0.20(0.235)	0.15(0.245)
top quartile		0.17(0.244)	0.14(0.252)
HIV/AIDS risk perception (no risk)[1]			
Low risk		0.34(0.177)	0.28(0.185)
Moderate/high risk		0.28(0.191)	0.26(0.202)
Personally knows someone with or died of HIV/AIDS (does not know)[1]		-0.12(0.183)	-0.17(0.191)
Contextual community HIV/AIDS awareness /perceptions			
Mean HIV/AIDS awareness index		-0.18(0.370)	-0.32(0.379)
Prop. know someone with or dead of AIDS		1.16(0.849)	1.83(0.911)*

Table 4.4 (continued)

Sexual/union risk factors			
Age at first sex (less than 16 years)[1]			
16-17 years			-0.16(0.200)
18-19 years			-0.34(0.235)
20 +			-1.05(0.311)*
Premarital sex (no premarital sex)[1]			-0.13(0.215)
High risk sexual behavior[2] (used condom at last sex or the partner was spouse)[1]			0.44(0.241)
Multiple sex partners (no multiple partner)[1]			-0.06(0.428)
Never had sex (first sex before age 16 years, no premarital sex, and neither multiple partners nor high risk sexual behavior[2])[1]			-0.71(0.489)
Marital/union status (married monogamous)[1]			
Married polygamous			0.27(0.229)
Widowed			1.93(0.278)*
Divorced/separated			0.65(0.250)*
Age at first marriage (<16 years)[1]			
16-17 years			-0.10(0.278)
18-19 years			0.24(0.278)
20 + years			0.42(0.276)
Never married (married at <16 years, monogamous union)[1]			0.08(0.371)
Contextual community level sexual behavior			
Prop. of males who had extramarital sex			0.53(0.455)
Prop. of males circumcised			-0.78(0.371)*
Random community level variations			
Intercept	0.00	0.00	0.00

Base population: Sample tested for HIV/AIDS with non-missing data on study variables (n=3151).
1 – reference category
2 - Did not use condom during last sex with partner other than spouse.
* - $p<0.05$.

With respect to sexual behavior and union characteristics, younger age at first sex and marital dissolution were associated with significantly higher risk of HIV/AIDS infection. Those who initiated sexual activity before age 16 years were about three times as likely to be HIV sero-positive as those who initiate sex after teenage. Although younger age at first sex was associated with higher HIV/AIDS risk, there was no significant association between age at first marriage and HIV/AIDS infection when other important factors were controlled for. Being widowed or divorced were both associated with significantly higher odds of HIV/AIDS infection. Widows were about seven times as likely while the divorced/separated were about twice as likely to be infected with HIV/AIDS than those in monogamous unions.

None of the contextual community level factors considered were associated with HIV/AIDS infection, except the proportion of males in the community who are circumcised. Women in communities where a higher proportion of males were circumcised were less likely to be infected with HIV/AIDS. The community random effect diminished once ethnicity was included in the model.

5 INDIVIDUAL/HOUSEHOLD AND COMMUNITY LEVEL ASSOCIATIONS BETWEEN HIV/AIDS AND FERTILITY

The analysis in this section comprises two parts. The first part examines the association between HIV/AIDS factors and desired fertility, while the second part focuses on the associations between HIV/AIDS factors and actual fertility, with special reference to the role of the proximate fertility determinants.

5.1 Association Between HIV/AIDS and Desired Fertility

It has been suggested that HIV/AIDS may have a role in the reversal of reproductive preferences in Kenya, through its contribution to an increase in child mortality, since women who have experienced the death of a child would be more likely than other women to want another child (Westoff & Cross, 2006). This section examines the association between various HIV/AIDS factors and reproductive preferences with reference to reported ideal family size and the desire to stop childbearing.

5.1.1 Bivariate associations

The bivariate associations suggest that actual and perceived HIV/AIDS risks are associated with the desire to limit fertility but not with the desired family size (Table 5.1). Although women who were HIV sero-positive were more likely to state that they wanted no more children, their ideal family size was not lower than those who were sero-negative. Similarly, those who perceived their HIV/AIDS risk to be high were more likely to state that they wanted no more children, but there was no significant difference in reported ideal family size by perceived HIV/AIDS risk.

Table 5.1 Percent of women who desire small families or want no more children, by HIV/AIDS indicators

HIV/AIDS factor	Ideal family size of 3 or fewer children	Want no more children	Cases
HIV/AIDS sero-status[Ψ]		*	
Negative	41.4	35.8	2998
Positive	37.5	42.3	275
Perceived HIV/AIDS risk[Ψ]		***	
None/low	41.4	29.7	3014
Medium	43.4	36.0	3105
High	41.4	46.4	1911
Risky sexual behavior (last sex no condom with partner other than spouse)	***		
No	40.6	36.3	7492
Yes	55.2	33.5	703
Ever previously tested for HIV/AIDS[Ψ]	***	**	
Tested	39.7	35.7	6811
Never tested before	57.0	39.9	1239
Knows someone with or who have died of AIDS[Ψ]	***	***	
Yes	36.8	30.0	2118
No	44.1	38.4	5902
HIV/AIDS knowledge index	***	***	
1st quartile (poorest knowledge)	28.0	31.0	2040
2nd quartile	38.1	39.8	2059
3rd quartile	46.0	38.5	1992
4th quartile (best knowledge)	54.7	34.5	2104
All	41.9	36.1	8195

Base population: all women in sample.
Ψ – Data for some cases missing or not applicable.
* - $p<0.05$, ** - $p<0.01$, *** - $p<0.001$

On the other hand, risky sexual behavior (i.e. non-use of condoms at last sex with partner other than spouse) was significantly associated with ideal family size, but not with the desire to limit fertility. Those who had risky sexual behavior were more likely to report a small desired family size of three or fewer children.

Having previously been tested for HIV/AIDS, personal acquaintance with HIV/AIDS victims and overall HIV/AIDS awareness were all significantly associated with both the desire for a small family size and the

desire to limit fertility. Contrary to the patterns observed above with respect to HIV/AIDS sero-status and risk perception, women who had never been previously tested for HIV/AIDS or did not know anyone ill or dead from HIV/AIDS were significantly more likely to report a small ideal family size and to want no more children, compared to those who had ever been tested or knew someone ill or dead of HIV/AIDS. Higher HIV/AIDS awareness was associated with increased desire for a small family size, while those with about average HIV/AIDS awareness were the most likely to report wanting no more children.

5.1.2 Multivariate association between HIV/AIDS indicators and desired fertility

Table 5.2 examines the individual and community-level HIV/AIDS risk factors on desired fertility. The contextual community-level HIV/AIDS factors were derived mainly from individual level HIV/AIDS factors (e.g. HIV/AIDS prevalence in the community, proportion who perceive themselves to be at moderate or high risk of HIV/AIDS infection, proportion who know someone with or who had died of AIDS, mean HIV/AIDS knowledge index). The analysis explored the possible role of child loss in the association between HIV/AIDS factors and desired fertility, and tested possible variation of the effect of HIV/AIDS factors in different communities.

Table 5.2 Individual and community/cluster level HIV/AIDS factors associated with desired fertility – Logistic regression parameter estimates (standard errors given in brackets)

Parameter	Want no more children	Small ideal family size of 3 or fewer children
Intercept	-2.84(0.327)	0.01(0.319)
Background control factors		
Educational attainment (no education)[1]		
Primary incomplete	0.26(0.121)*	0.14(0.133)
Primary complete	0.44(0.130)*	0.34(0.138)*
Secondary+	0.50(0.137)*	0.85(0.140)*
Rural residence (urban)[1]	-0.21(0.118)	-0.13(0.120)
Wealth index (poorest quartile)[1]		
2nd quartile	-0.03(0.092)	0.06(0.091)
3rd quartile	-0.02(0.107)	0.26(0.101)*
Richest quartile	-0.04(0.153)	0.55(0.143)*
Ethnicity (Kikuyu)[1]		
Luhya	-0.20(0.153)	-0.43(0.135)*
Luo	-0.11(0.173)	-0.42(0.151)*
Kamba	-0.46(0.171)*	-0.08(0.152)
Kalenjin	-0.36(0.172)*	-0.66(0.165)*
Mijikenda/Swahili	-1.16(0.245)*	-0.75(0.225)*
Kisii	-0.23(0.203)	0.03(0.190)
Meru/Embu	-0.01(0.202)	0.21(0.189)
Other	-0.65(0.168)*	-0.77(0.156)*
Religion (Roman Catholic)[1]		
Protestant	0.16(0.075)*	-0.17(0.067)*
Muslim/other	0.11(0.147)	-0.26(0.142)
Region (Nairobi)[1]		
Central	0.55(0.178)*	0.43(0.179)*
Coast	0.47(0.194)*	0.12(0.187)
Eastern	0.61(0.205)*	0.56(0.200)*
Nyanza	0.06(0.201)	-0.13(0.200)
Rift valley	0.38(0.169)*	0.19(0.171)
Western	0.38(0.192)*	0.14(0.189)
North Eastern	-1.77(0.325)*	-2.54(0.796)*
Age (15-19 years)[1]		
20-24	-0.26(0.142)	0.28(0.093)*
25-29	-0.18(0.153)	0.15(0.114)
30-34	0.22(0.162)	0.04(0.130)
35 +	0.46(0.165)*	-0.36(0.134)*

Table 5.2 (continued)

Parity (0)[1]		
1	1.64(0.160)*	0.48(0.104)*
2-3	3.25(0.180)*	-0.09(0.118)
4-5	4.03(0.200)*	-0.76(0.143)*
6 +	4.70(0.218)*	-0.90(0.168)*
Marital/union status (never married)[1]		
Married monogamous	-0.56(0.128)*	-0.37(0.098)*
Married polygamous	-0.50(0.153)*	-0.24(0.137)
Widowed	0.57(0.193)*	-0.11(0.182)
Divorced/separated	0.56(0.159)*	0.20(0.138)
Child mortality experience		
Ever experienced under-5 child loss	-0.49(0.084)*	-0.04(0.092)
Proportion in cluster who experienced child loss	-0.11(0.167)	-0.47(0.188)*
Ever experienced foetal loss	-0.19(0.092)*	-0.16(0.097)
Individual level HIV/AIDS factors		
HIV sero-status (negative)[1]		
Positive	0.04(0.166)	-0.23(0.156)
Status not known/not tested	0.05(0.064)	-0.02(0.058)
Perceived risk of HIV/AIDS (no risk)[1]		
Low risk	-0.04(0.075)	0.06(0.066)
Moderate/high risk	0.10(0.084)	0.14(0.078)
Index of HIV/AIDS awareness (lowest quartile)[1]		
2nd quartile	-0.09(0.095)	-0.12(0.088)
3rd quartile	-0.23(0.100)*	0.04(0.090)
top quartile	-0.21(0.104)*	0.15(0.093)
Knows person with or who died of AIDS	-0.01(0.083)	0.08(0.073)
Contextual cluster level HIV/AIDS factors		
Proportion who are HIV/AIDS positive /prevalence	-0.55(0.444)	-0.26(0.449)
Prop. who perceive HIV/AIDS risk as mod./high	0.41(0.292)	0.37(0.300)
Mean index of HIV/AIDS awareness	0.39(0.128)*	0.80(0.147)*
Prop. who know someone with or dead of AIDS	-0.53(0.298)	-0.56(0.315)
Community/Cluster Level Random Variance		
Intercept	0.10(0.032)*	0.19(0.034)*

Base population: All women with non-missing data on analysis variables (n=7994)
1 – reference category
* - $p<0.05$.

Background socio-economic and demographic risk factors

The association between background socio-economic factors and desired fertility generally conformed to the expected patterns. Higher educational attainment was associated with lower desired fertility, with those having at least secondary education being the most likely to state that they wanted no more children and also the most likely to report a small ideal family size of no more than three children. Similarly, higher socio-economic status (i.e. wealth index) was associated with lower ideal family size (ideal family size of three or fewer children), but there was no association between wealth index and the desire to limit fertility (i.e. want no more children). Rural residence was generally associated with higher desired fertility, but the effect ceased to be significant when contextual community level HIV/AIDS factors were introduced in the model.

There were significant variations in desired fertility by region, ethnicity and religion. Women in North Eastern province were the least likely to want no more children or have a small ideal family size, while those in Eastern province and Central were the most likely. The Mijikenda/Swahili and other minority ethnic groups were the least likely to indicate desire to limit fertility or have a small ideal family size, while the Kikuyu and the Meru/Embu were the most likely to desire lower fertility. The patterns of desired fertility by religious affiliation were not straightforward. The Protestants were more likely to desire to limit fertility but at the same time less likely to desire small family size compared to the Catholics.

As might be expected, there were strong associations between demographic factors and reproductive preferences. Older women (aged 35 or more years) were more likely to desire to limit fertility, but less likely to desire a small family. The desire to have no more children sharply rose with parity, but those of higher parity were less likely to desire small families. It was interesting to note that women with one child were significantly more likely to report a small ideal family size than those with no children. Those in union were less likely to want no more children or to desire small families.

The role of child mortality

The results confirm the expected significant role of child mortality in reproductive preferences. Women who had ever experienced under-five child mortality or fetal loss were significantly less likely to want no more children. Furthermore, women in communities with higher child mortality were less likely to report a small ideal family size. These patterns suggest that while personal experience of child death affects whether or not the woman wants another child, community child mortality affects ideal family size, which can be viewed as more reflective of community norms. This is consistent with insurance behavior at the community level and replacement behavior at the individual level.

Individual and community-level HIV/AIDS factors

The results suggest that HIV/AIDS awareness, rather than sero-status or perceived risk, is the important factor in reproductive preferences. At the individual level, higher HIV/AIDS awareness was associated with reduced desire to limit fertility (want no more children). All the other individual level HIV/AIDS factors, including sero-status, perceived risk or personal acquaintance with AIDS victims were not significantly associated with desired fertility. At the community (cluster) level, the mean HIV/AIDS awareness index was associated with the desire to limit fertility as well as ideal family size. Women in communities with higher HIV/AIDS awareness were more likely to state that they wanted no more children and to report a small ideal family size of three children or fewer.

5.2 Association between HIV/AIDS Factors and Recent Fertility

As noted by the United Nations (2002), the effect of HIV/AIDS on fertility may operate both at individual level and at the aggregate level. At the individual level, there may be differential effects on infected and uninfected women. While the effect of HIV/AIDS on fertility of infected women may be through both the biological and behavioral proximate determinants of fertility, the effect on uninfected women mainly operates through behavioral mechanisms. This section focuses on how individual and community-level HIV/AIDS knowledge, risk perceptions, and sero-status are associated with recent fertility patterns in Kenya; the proximate fertility determinants through which HIV/AIDS factors influence fertility; and the relationship between HIV/AIDS factors and recent fertility at aggregate (community) level.

Understanding the mechanisms through which HIV/AIDS factors influence fertility is crucial in determining what components of the population and reproductive health programming may need to be targeted. For instance, is it possible that high infant mortality due to HIV/AIDS is leading to increased fertility through "replacement" or "insurance" effect? Also, is it possible that reduction in breastfeeding due to perceived or real risk of HIV transmission is contributing to increased fertility? It is important to understand what implications this has on current breastfeeding guidelines, or perhaps more importantly on postpartum contraceptive recommendations, since breastfeeding guidelines are driven by risks of mother to child transmission versus risks of not breastfeeding for the infant.

5.2.1 Bivariate associations

The bivariate associations between HIV/AIDS factors and recent fertility among all women, women who have ever had sex, and currently married women are shown in Table 5.3. Sexually active women who were HIV sero-positive were significantly less likely to have had a birth in the three years preceding the survey than those who were sero-negative. Although perceived higher risk of HIV/AIDS appeared to be associated with higher fertility, the association was not significant when the sample was restricted to sexually active or currently married women. However, women who had previously never been tested for HIV/AIDS, or did not know anyone with HIV/AIDS, or had poor HIV/AIDS awareness were more likely to have had a recent birth than their counterparts who had previously been tested, knew someone with HIV/AIDS of had high HIV/AIDS awareness.

The profile of sexually active HIV-infected and uninfected women by proximate determinants of fertility or related factors (Table 5.4) show significant associations by marital status, age at first sex and experience of child loss. Compared to uninfected women, a significantly lower proportion of HIV-infected women were in monogamous unions while a higher proportion were in dissolved unions (widowed, divorced, or separated). For instance, only 41 percent of sexually-active women who were infected with HIV/AIDS were in monogamous unions, compared to 60 percent of uninfected women. On the other hand, the proportion of HIV/AIDS infected women who were widowed, divorced, or separated was almost triple that of uninfected women. HIV/AIDS infected women were more likely to have initiated sexual activity earlier than their counterparts who were uninfected. Also, those who were infected were significantly more likely to have experienced a child loss (33 percent) than those who were uninfected (22 percent).

More proximate determinants of fertility show significant associations with risk perception of HIV/AIDS than with sero-status. Consistent with the patterns of sero-status, women who perceived their risk of HIV/AIDS as moderate or high were more likely to have experienced a child loss than those who perceived their risk as none or low (Table 5.5). In addition, those who perceived their risk as high or moderate were also more likely to have experienced a fetal loss. The relationship between HIV/AIDS risk

perception and age at first sex is also consistent with that of sero-status, but the association is weaker. Although marital status shows a strong association with perceived risk of HIV/AIDS, the pattern was not consistent with that of HIV sero-status. Unlike sero-status where marital dissolution was a major risk factor, it was being married in a polygamous union that was associated with perceived higher risk of HIV/AIDS. A considerably higher proportion of women who perceived their HIV/AIDS risk as high or moderate were in polygamous union (24 percent) than those who perceived their risk as none (11 percent). One important proximate determinant of fertility that shows a significant association with perceived risk of HIV/AIDS, but not with sero-status is contraceptive use. Current use of contraceptives was associated with perceived higher risk of HIV/AIDS.

Table 5.3 Percent (weighted) of all, sexually active, and currently married women who had a birth within the last three years prior to the survey by HIV/AIDS indicators

HIV/AIDS Factor	All women	Sexually active	Currently married
HIV/AIDS Sero-status$^{\Psi}$		**	
Negative	38.5	46.6	53.9
Positive	37.1	38.2	49.1
Perceived HIV/AIDS risk$^{\Psi}$	***		
None	31.2	44.5	53.9
Low	40.4	46.5	54.7
Medium/High	45.2	47.0	51.4
Ever previously tested for HIV/AIDS$^{\Psi}$	***	*	*
Tested	36.8	45.3	52.8
Never tested before	46.5	49.1	56.6
Knows someone with or who has died of AIDS$^{\Psi}$	***	***	***
No	41.9	53.6	62.6
Yes	37.0	43.6	50.5
HIV/AIDS knowledge index	*	***	***
1st quartile (poorest knowledge)	41.0	53.0	61.0
2nd quartile	39.0	47.0	53.2
3rd quartile	37.7	43.7	50.0
4th quartile (best knowledge)	36.2	42.5	51.6
All			
Percent	38.4	46.3	53.7
Cases	8195	6797	4876

Ψ – Data for some cases missing or not applicable.
* - p<0.05, ** - p<0.01, *** - p<0.001

Table 5.4 Profile of sexually active HIV-infected and uninfected women by proximate determinants of fertility

Proximate determinant of fertility	Non-infected	Infected	All women
Current contraceptive use			
Non-user	65.9	69.6	66.2
User	34.1	30.4	33.8
Recent breastfeeding practice			
Breastfed <12 months	22.7	22.3	22.7
12-23 months	23.9	21.9	23.7
24-60 months	12.6	13.8	12.7
Did not breastfeed	1.4	1.1	1.4
No recent birth/missing	39.4	41.0	39.6
Recent birth interval (**)			
Less than 2 years	13.9	15.8	14.1
2-3 years	23.8	19.0	23.3
3 years or longer	31.8	33.8	32.0
First birth	16.6	22.5	17.2
No recent birth	13.9	8.8	13.4
Current marital/union status (***)			
Never married	15.1	13.1	14.9
Married (monogamous)	60.2	41.3	58.3
Married (polygamous)	14.0	15.9	14.2
Widowed	4.0	15.5	5.1
Divorced/separated	6.8	14.1	7.5
Age at first marriage			
15 or younger	14.9	14.5	14.9
16-17	19.4	17.7	19.3
18-19	20.5	21.6	20.7
20 +	30.0	33.2	30.3
Never married	15.1	13.1	14.9
Age at first sex (**)			
15 or younger	36.1	45.4	37.0
16-17	24.7	22.7	24.5
18-19	21.7	22.0	21.7
20 +	17.5	9.9	16.7
Ever experienced infant/child loss (***)			
No	78.4	67.1	77.3
Yes	21.6	32.9	22.7
Ever experienced foetal loss			
No	86.4	87.3	86.5
Yes	13.6	12.7	13.5
Number of women	2468	266	2734

Base population: sexually active sample tested for HIV/AIDS (n=2734)
(*) - $p<0.05$, (**) - $p<0.01$, (***) - $p<0.001$

Table 5.5 Profile of sexually active women who perceive their risk of HIV/AIDS infection as none, low or moderate/high by proximate determinants of fertility

Proximate determinant of fertility	No risk	Low risk	Moderate or high risk	All women
Current contraceptive use (***)				
Non-user	70.7	64.2	62.3	65.6
User	29.3	35.8	37.7	34.4
Recent breastfeeding practice (*)				
Breastfed <12 months	20.3	22.6	23.9	22.3
12-23 months	22.8	22.9	23.2	22.9
24-60 months	11.7	12.2	13.3	12.4
Did not breastfeed	1.3	1.6	1.2	1.4
No recent birth/missing	43.9	40.7	38.3	41.0
Recent birth interval (***)				
Less than 2 years	15.0	12.7	14.8	14.0
2-3 years	20.9	22.7	24.1	22.6
3 years or longer	30.1	30.4	36.0	31.9
First birth	18.3	18.8	15.8	17.8
No recent birth	15.7	15.4	9.3	13.8
Current marital/union status (***)				
Never married	17.7	16.7	11.6	15.6
Married (monogamous)	57.9	62.7	54.4	58.9
Married (polygamous)	10.6	8.2	23.5	13.3
Widowed	6.8	4.8	3.5	5.0
Divorced/separated	6.9	7.6	7.0	7.2
Age at first marriage (***)				
15 or younger	14.6	13.2	14.0	13.9
16-17	19.2	17.1	20.8	18.8
18-19	18.8	21.2	21.0	20.4
20 +	29.6	31.8	32.6	31.3
never married	17.7	16.7	11.6	15.6
Age at first sex (*)				
15 or younger	33.8	35.0	36.1	35.0
16-17	24.1	24.9	26.1	25.0
18-19	24.2	21.3	22.6	22.5
20 +	17.8	18.8	15.1	17.5
Ever experienced infant/child loss (***)				
No	80.0	78.5	74.3	77.7
Yes	20.0	21.5	25.7	22.3
Ever experienced fetal loss (***)				
No	89.1	87.7	84.7	87.3
Yes	10.9	12.3	15.3	12.7
Number of women	2144	2695	1832	6671

Base population: sexually active women (overall n=6671)
(*) - $p<0.05$, (**) - $p<0.01$, (***) - $p<0.001$

5.2.2 Multivariate association between HIV/AIDS indicators and recent fertility

Table 5.6 examines individual and community-level HIV/AIDS risk factors on individual level fertility, taking into account significant background characteristics. Special focus is placed on the role of the proximate determinants of fertility to explore potential pathways through which HIV/AIDS may have affected fertility.

Background socio-economic and demographic characteristics

As might be expected, the results of the multivariate analysis confirm lower fertility among the more affluent women. Women who were employed or with higher wealth index were less likely to have had a birth in the three years prior to the survey compared to those who were unemployed or poorer. Primary education appeared to be associated with higher fertility, but the effect diminished when proximate determinants of fertility (especially marital status) were included in the model. This suggests that the apparent higher fertility among those with lower education observed in Model 1 was partly attributable to a higher proportion being in union.

The results show significant regional variations in fertility. Both Rift Valley and Eastern provinces were associated with higher recent fertility than Nairobi. There were also significant variations in recent fertility by ethnicity and religious affiliation. The Luhya, Luo, and Kalenjin ethnic groups had significantly higher fertility than the Kikuyu, even after taking into account the effect of proximate determinants of fertility. With respect to religion, the Muslims were associated with higher fertility than the Roman Catholics.

Women in their twenties were significantly more likely to have had a recent birth compared to those aged 15-19 years, but those aged 35 years or older had the lowest recent fertility. Having had at least one child before the observation period was associated with significantly lower odds of having a recent birth when proximate fertility determinants (especially marital status) were taken into account.

Child mortality

Consistent with the patterns of fertility desires, women who had experienced a child loss before the observation period were significantly more likely to have a recent birth than those who had not previously lost a child. However, it was interesting to note that living in a community where child mortality was high was associated with reduced odds of having a recent birth.

Table 5.6 Individual and community/cluster level HIV/AIDS factors associated with having a recent birth (last 3 years) – multilevel logistic regression parameter estimates (standard errors in brackets)

Parameter	Model 1	Model 2
Intercept	-0.49(0.299)	-1.08(0.307)
Background control factors		
Educational attainment (none)[1]		
Primary incomplete	0.28(0.115)*	0.15(0.119)
Primary complete	0.25(0.123)*	0.13(0.129)
Secondary+	-0.00(0.130)	-0.07(0.137)
Employed (unemployed)[1]	-0.27(0.064)*	-0.21(0.067)*
Wealth index (poorest quartile)[1]		
2nd quartile	-0.35(0.085)*	-0.34(0.088)*
3rd quartile	-0.66(0.096)*	-0.71(0.099)*
Richest quartile	-0.97(0.128)*	-1.09(0.132)*
Ethnic group (Kikuyu)[1]		
Luhya	0.42(0.142)*	0.48(0.148)*
Luo	0.63(0.157)*	0.73(0.164)*
Kamba	0.17(0.158)	0.28(0.166)
Kalenjin	0.41(0.160)*	0.50(0.164)*
Mijikenda/Swahili	0.31(0.223)	0.22(0.227)
Kisii	-0.09(0.188)	-0.07(0.191)
Meru/Embu	-0.38(0.195)*	-0.30(0.200)
Other	0.34(0.157)*	0.29(0.161)
Religion (Roman Catholic)[1]		
Protestant	0.11(0.070)	0.04(0.073)
Muslim/other	0.42(0.137)*	0.36(0.141)*
Region (Nairobi)[1]		
Central	0.32(0.157)*	0.26(0.157)
Coast	0.04(0.179)	0.04(0.180)
Eastern	0.49(0.183)*	0.43(0.187)*
Nyanza	0.28(0.180)	0.17(0.181)
Rift valley	0.58(0.153)*	0.47(0.153)*
Western	0.38(0.177)*	0.26(0.178)
North Eastern	-0.17(0.261)	-0.37(0.260)
Age (15-19 years)[1]		
20-24	1.12(0.107)*	0.94(0.117)*
25-29	0.93(0.127)*	0.68(0.138)*
30-34	0.49(0.144)*	0.24(0.154)
35 +	-0.99(0.155)*	-1.15(0.166)*

Table 5.6 (continued)

Parity 3 years prior to survey (0)[1]		
1	-0.05(0.097)	-0.43(0.107)*
2-3	0.05(0.107)	-0.52(0.117)*
4-5	0.13(0.138)	-0.45(0.147)*
6 +	0.07(0.156)	-0.47(0.166)*
Child mortality experience		
Had under-5 child loss 3 yrs before survey	0.18(0.086)*	0.26(0.089)*
Per cent Under-5 mortality rate in cluster	-0.02(0.005)*	-0.02(0.005)*
Individual level HIV/AIDS factors		
HIV sero-status (negative)[1]		
Positive	-0.49(0.154)*	-0.40(0.162)*
Status not known/not tested	0.07(0.059)	0.09(0.062)
Perceived risk of HIV/AIDS (no risk)[1]		
Low risk	0.14(0.069)*	0.07(0.072)
Moderate/high risk	0.24(0.078)*	0.12(0.083)
Index of HIV/AIDS awareness (lowest quartile)[1]		
2nd quartile	0.11(0.089)	0.06(0.093)
3rd quartile	0.08(0.093)	0.04(0.098)
Top quartile	0.06(0.097)	0.04(0.103)
Knows person with or who died of AIDS	-0.11(0.076)	-0.17(0.080)*
Contextual cluster level HIV/AIDS factors		
Prevalence of HIV/AIDS in cluster	-0.07(0.396)	-0.38(0.395)
Prop. who perceive HIV/AIDS risk as mod./high	-0.19(0.268)	-0.15(0.266)
Mean index of HIV/AIDS awareness	-0.37(0.116)*	-0.32(0.116)*
Prop. who know someone with or dead of AIDS	-0.03(0.280)	0.11(0.279)
Proximate fertility determinants		
Marital status (never married)[1]		
Married monogamous		1.70(0.106)*
Married polygamous		1.55(0.134)*
Widowed		0.77(0.195)*
Divorced/separated		1.16(0.143)*
Ever used contraception		0.13(0.074)
Months since last sex		-0.01(0.003)*
Experienced foetal loss		-0.30(0.090)*
Mean breastfeeding duration in cluster		-0.12(0.020)*
Community level random variance		
Intercept	0.08(0.027)*	0.05(0.026)

Base population: ever sexually active sample (n=6643).
1 – reference category.
* - $p<0.05$.

Individual and contextual cluster level HIV/AIDS risk factors

The results confirm the earlier observed fertility inhibiting effect of HIV/AIDS among infected women. Women who were HIV sero-positive were significantly less likely to have had a recent birth than those who were sero-negative. The effect was reduced when proximate determinants of fertility, especially marital status, were taken into account but remained significant altogether. Compared to HIV sero-negative women, those who were sero-positive had on average about 40 percent lower odds of having a recent birth, when significant background socio-economic and demographic factors and child mortality experience were controlled for. After the proximate determinants of fertility relating to sexual exposure, duration of breastfeeding and fetal loss were taken into account, the odds for HIV-positive women were 33 percent lower. This reduction was mainly accounted for by sexual exposure factors relating to union status.

The results show no evidence of a significant association between community (cluster) level HIV prevalence and fertility. In addition, various interactions between HIV sero-status and important individual level factors including observed and unobserved cluster-level factors were considered but there was no evidence that the association between HIV sero-status and fertility varied significantly between different population sub-groups.

There was some indication that perceived high risk of HIV/AIDS was associated with higher recent fertility, but the effect ceased to be significant when proximate fertility determinants (especially marital status and duration since last sex) were taken into account. Also, there was some indication that personal acquaintance with AIDS victims was associated with lower recent fertility, especially when marital status was taken into account.

There was no evidence of a significant association between women's HIV/AIDS awareness and their recent fertility behavior. However, women in communities with higher HIV/AIDS awareness had significantly lower odds of having a recent birth, even after controlling for significant background factors and proximate determinants of fertility.

Proximate determinants of fertility

As would be expected, women who had never been in union had considerably lower odds of having a recent birth than those currently in union or previously in union (i.e. divorced/separated or widowed. Other significant proximate determinants included sexual activity, fetal loss and duration of breastfeeding. Longer duration since last sex and experience of a fetal loss were both associated with lower recent fertility. In addition, women in communities where the mean duration of breastfeeding was longer had lower odds of having a recent birth. However, it was interesting to note that contraceptive use was not significantly associated with recent fertility. It is possible that some contraceptive use may have occurred after the birth and indeed may be the result of the recent birth, diluting the expected fertility inhibiting effect of contraception.

Community (cluster) level variations in fertility

There was some indication of a significant variation in recent fertility across communities in Kenya. However, the community level variation ceased to be significant when the mean duration of breastfeeding in the community was included in the model, suggesting that the community variations were attributable to differences in the duration of breastfeeding across communities. Although the effect of HIV/AIDS sero-status was allowed to vary at cluster level, there was no evidence that the association between HIV/AIDS and recent fertility varied significantly across communities.

6 DISCUSSIONS AND CONCLUSIONS

The main objectives of this study were to: examine the regional variations in the link between HIV/AIDS and fertility; explore possible mechanisms through which HIV/AIDS influences fertility; and examine the effect of individual and community-level HIV/AIDS factors on recent fertility pattern in Kenya. The analysis of background trends and regional variations in fertility indicators and the proximate determinants show some regional patterns that may be linked to the effect of HIV/AIDS, especially at very high HIV/AIDS prevalence levels (i.e. Nyanza province). Recent changes in some of the proximate determinants of fertility and reproductive intentions which may be responsible for the observed stall in fertility decline in Kenya may be partly attributable to the HIV/AIDS epidemic. The results corroborate findings from earlier studies with respect to the fertility inhibiting effect of HIV/AIDS among infected women, but the understanding of the community-level HIV/AIDS effect on fertility remains unclear.

There are potential data limitations that should be borne in mind while interpreting the findings of this study. The first relates to the problem of causality, since it is unclear when HIV/AIDS infections took place. Hence, the study focuses on associations, rather than causal relationships. The second one relates to possible selectivity bias in HIV/AIDS test data. High fertility HIV/AIDS sero-positive women are more likely to develop AIDS symptoms and die earlier, since pregnancy may hasten AIDS progression. Hence, HIV-positive women interviewed may represent a select sub-group with low fertility, distorting the observed relationship between HIV/AIDS and fertility. Although there were further concerns about possible selectivity bias in HIV/AIDS test data due to refusals to have the test, preliminary analysis showed little evidence of systematic selectivity in refusals by key factors associated with HIV sero-status or fertility. Nevertheless, these data limitations should be borne in mind while interpreting the findings.

6.1 Individual and Community-Level HIV/AIDS Effects on Fertility

The associations between HIV/AIDS and desired fertility suggested that HIV/AIDS awareness, rather than sero-status or risk perception, was the important factor in reproductive preferences. Women in communities with higher HIV/AIDS awareness were more likely to want no more children and to desire smaller families. These associations were observed after controlling for the effect of education, implying that the patterns are not attributable to higher educational attainment among those with higher HIV/AIDS awareness. The patterns may suggest reasonable integration of reproductive health information, education and communication (IEC), such that communities with higher HIV/AIDS awareness also endorse prevailing family planning messages that tend to encourage small families.

The analysis of the link between HIV sero-status and actual fertility confirmed the expected fertility inhibiting effect of HIV/AIDS among infected women. On average, women who were HIV sero-positive had about 40 percent lower odds of having a recent birth than their uninfected counterparts of similar background characteristics and child mortality experience. After taking into account the proximate determinants relating to sexual exposure, duration on breastfeeding and fetal loss, the odds for HIV sero-positive women were 33 percent lower. These patterns are consistent with findings in earlier studies in sub-Saharan Africa which suggest that fertility of HIV-positive women is 25 percent to 40 percent lower than for uninfected women (Ryder et al., 1991; Allen et al., 1993; Zaba & Gregson, 1998; DeRose, 2006).

The low fertility among HIV/AIDS women observed after taking into account the proximate fertility determinants may be attributable to the other proximate factors not included in the analysis. In particular, the effect of HIV/AIDS on fertility may be partly through secondary infertility, given the expected strong correlation between HIV/AIDS infection and other sexually transmitted diseases, some of which are major causes of secondary infertility. Nevertheless, it is also important to point out that lower fertility among HIV/AIDS infected women observed in survey data may be partly due to selectivity bias discussed

above, since higher fertility HIV/AIDS sero-positive women are more likely to develop AIDS symptoms and die earlier, implying that HIV-positive women interviewed may represent a select sub-group with low fertility.

At community level, the results show no evidence of a significant association between community-level HIV/AIDS prevalence and fertility. This does not support findings from an earlier study which suggested that living in a community with a higher HIV prevalence was associated with higher fertility (DeRose, 2006). A number of factors may explain the apparent discrepancy between our finding and the association observed in the earlier study: The earlier analysis was restricted to currently married women aged at least 18 years, while this study considers all ever sexually active women of reproductive age; and some of the key factors that partly explain community-level variations in fertility such as ethnicity were not included in the earlier analysis.

The individual and community-level HIV/AIDS effects on fertility discussed here provide little explanation for the stall in fertility decline in Kenya. The fact that HIV/AIDS has a fertility inhibiting effect on infected women while there is no evidence of a significant effect at community level may seem to suggest that high HIV/AIDS prevalence should in fact result in fertility decline, contrary to the recent trends and regional patterns observed in Kenya. This highlights the complex nature of the relationship between fertility and HIV/AIDS, alluded to in Section 1.2.

6.2 Possible Mechanisms through which HIV/AIDS May Have Influenced Fertility in Kenya

There is evidence that HIV/AIDS may have contributed to reduced fertility in Kenya mainly through reduced sexual exposure, especially marital dissolution (i.e. widowhood, divorce, or separation). The analysis of factors associated with HIV/AIDS infections showed a particularly high risk of infection among the widowed or the divorced/separated. These groups are also observed to have reduced recent fertility.

Two mechanisms through which the HIV/AIDS epidemic has possibly contributed to increased fertility in Kenya are its contribution to increased infant/child mortality and reduced duration of breastfeeding. The analysis of factors associated with fertility indicators identified child loss as a significant factor in desired as well as actual fertility. Women who had experienced under-five child mortality or fetal loss were significantly less likely to desire to stop childbearing. Consistent with the patterns of fertility desires, women who had experienced a child loss before the observation period were significantly more likely to have had a recent birth. However, it was interesting to note that being in communities with higher child mortality was associated with reduced odds of having a recent birth. The observed patterns suggest possible "replacement" rather than "insurance" phenomenon.

The analysis of factors associated with recent fertility in Kenya identified duration of breastfeeding as an important factor, with longer mean duration of breastfeeding in communities being associated with lower fertility. Given the high public awareness of the risk of HIV transmission during breastfeeding (Ministry of Health, 2005), actual or perceived risk of HIV/AIDS is likely to lead to reduced duration of breastfeeding. Correlation analysis between HIV/AIDS prevalence in clusters and mean duration of breastfeeding (not shown) confirmed that clusters with higher HIV/AIDS prevalence had significantly shorter mean duration of breastfeeding ($p<0.01$).

The analysis of overall trends in fertility and the proximate determinants suggested that while recent trends in some of the indicators of fertility such as shortening of birth interval, stalled increase in contraceptive use, and a decline in the proportion of women who want no more children were consistent with the observed stall in fertility decline, the trends in sexual exposure factors, namely, rising age at first sex and

age at first marriage, coupled with a decline in the proportion of women in union might be expected to sustain a declining trend in fertility. It is possible that the overall fertility enhancing effects of the desire for more children, accompanied with a stalled increase in contraceptive use has offset the fertility-suppressing effects of changes in sexual exposure factors, resulting in the observed stall in fertility decline in Kenya.

6.3 Regional Patterns in Indicators of Fertility and Possible Link with HIV/AIDS

The regional trends in fertility and the proximate determinants show interesting patterns in relation to HIV/AIDS prevalence. The most notable recent increase in fertility, and the greatest decline in contraceptive prevalence were observed in Nyanza province, the region with the highest HIV/AIDS prevalence. On the other hand, contraceptive prevalence increased most notably in Western province, the region with the lowest HIV prevalence among women (besides North Eastern province).

The regional patterns in the other proximate determinants of fertility are also consistent with the observed reversal of fertility decline in Nyanza. For instance, both age at first sex and age at first marriage are lowest in Nyanza province, and the region has also witnessed the least overall rise in age at first sex and first marriage between 1993 and 2003. While the rise in age at first sex was greatest in Nairobi, the region with the second highest HIV/AIDS prevalence, the rise was minimal in Nyanza. The regional patterns further show that the duration of breastfeeding declined most notably in Nairobi, Western and Nyanza, and it is possible that HIV/AIDS may have had a role — especially in Nyanza and Nairobi, the two regions with the highest HIV/AIDS prevalence.

Perhaps the most important regional patterns of significance to the HIV/AIDS and fertility link relate to reproductive intentions and child mortality experiences. Nyanza province has consistently recorded the highest infant and child mortality over the years, and even though the increase in the 1998-2003 period was relatively lower than the other regions, the level is still considerably higher than the other regions. The high HIV/AIDS prevalence has undoubtedly contributed to the elevated infant and child mortality levels in the region. It is possible that infant and child mortality in the region has reached appreciably high levels where the effect of the "replacement" phenomenon is substantial enough to result in the observed reversal of fertility decline.

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